



Banking and finance in the digital age: AI's transformative evolution and its implications

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Abstract

In the modern era of the 21st century, where the whole world is moving towards digitalisation, artificial intelligence (AI) represents an advancement in this direction. This research provides a comprehensive analytical study on the integration of AI in Banking and Finance industry. The research underscores the transformation of conventional banking and financial practices by using AI, emphasising its capacity to enhance customer interactions. It explores AI applications, benefits, challenges, and prospects within this sector. The current scenario of AI is rapidly redefining the banking and finance landscape, with applications ranging from detecting fraud and risk assessment to automated support and investment advice for customers. These implementations have resulted in greater efficiency, reduced operational costs, and an improved understanding of customer behaviours. Nevertheless, the banking industry grapples with data security and ethical challenges that are associated with AI. However, AI in Banking and Finance remains promising in future as well, offering further innovation, enhanced customer experiences, and a safer and more efficient financial ecosystem. The study highlights how AI is playing a major role in the transformation of traditional banking and financial operations while improving customer experiences.

Keywords: Artificial Intelligence, banking and finance, machine learning, data analysis, customer experience

Introduction

The background of Artificial Intelligence (AI) is very rich which is marked by significant growth and development over the years. Here is a brief overview of the background and growth of AI, with references to key milestones and advancements:

- 1. Foundations of AI (1950s - 1960s):** The term "Artificial Intelligence" was coined by John McCarthy in 1956, signifying the official inception of the field. McCarthy, along with Marvin Minsky and Nathaniel Rochester, organized the Dartmouth Workshop, often considered the first AI conference (McCarthy, 1955). Early AI research emphasized symbolic logic, reasoning, and problem-solving. Allen Newell and Herbert A. Simon, 1956 created the Logic Theorist, a program that proved mathematical theorems.
- 2. AI Winter (1970s - 1980s):** AI faced setbacks in the 1970s, entering the "AI Winter" as funding declined and progress stalled (McCorduck, 2004). Expert systems, rule-based AI systems designed for specific tasks, gained popularity during this period (Feigenbaum *et al.*, 1992) ^[11].
- 3. Renaissance of AI (Late 20th Century):** The 1980s and 1990s saw a resurgence of AI with the development of machine learning algorithms, including backpropagation, which contributed to the growth of neural networks (Ekundayo and Ezugwu, 2025) ^[9]. Defense Advanced Research Projects Agency (DARPA) funding for autonomous vehicles research and natural language processing further fueled AI advancements (Day, 1993) ^[6].
- 4. Machine Learning and Deep Learning (21st Century):** The 21st century marked a remarkable growth in AI as techniques of machine learning like support vector machines and decision trees gained popularity in applications such as recognition of speech and classification of image (Bishop, 2006) ^[3]. Deep

learning, a branch of machine learning, advanced significantly with the development of convolutional (CNNs) and recurrent neural networks (RNNs), (LeCun *et al.*, 2015; Hochreiter and Schmidhuber, 1997) ^[15]. AI powered applications like voice assistants and recommendation systems became mainstream.

- 5. AI in Industry (2020s - Present):** AI has made significant inroads into several industries such as transportation, finance, healthcare and entertainment. Companies like Google, Facebook, and OpenAI have played an important role in AI innovations, that leads to the development of advanced AI models like GPT-4 (Trautman *et al.*, 2023) ^[25].

Since its inception in the 1950s, AI has made remarkable progress. Its growth has been marked by periods of optimism and setbacks, but it has continued to evolve and become an important part of modern technology and society.

This paper underscores artificial intelligence's (AI) transformative impact on the banking and finance industry. It highlights AI's potential to revolutionize banking operations, drive innovation in financial products and services, and enhance customer experiences significantly (Deepthi and Bansal, 2024) ^[7]. AI is seen as a disruptor in the industry, offering benefits in cost reduction, improved efficiency and customer satisfaction (Solanki 2022) ^[24]. However, adopting AI in banking organisations faces challenges, including barriers to implementation and customer acceptance of AI-driven decisions (Solanki 2022) ^[24]. The papers also discuss the transformation of the sectors from automation to personalisation, enabling personalised products and interactions. AI is a driving force for advancement in the financial services industry, pushing players to seek alternative solutions to old problems (Aldasoro 2024) ^[7]. The table represents the collated literature review of the topic.

Table 1: Collated literature review on AI and finance in the Banking and Financial Industry

S.No.	Title	Interpretation	Author
1	Artificial intelligence in mobile banking applications	Intelligence positively influences users' adoption of mobile banking apps by enhancing trust and Task-Technology Fit (TTF), yet higher anthropomorphism is associated with increased perceived cost. However, both factors have no significant impact on users' perceived risk, offering valuable insights for AI-driven mobile banking strategies.	Lee <i>et al.</i> , 2022 ^[19]
2	Artificial Intelligence in the Banking Sector	AI and ML-driven banking services bring substantial expansion, increased penetration, and improved cost-effectiveness, reshaping the industry to meet customer demands conveniently and securely, ushering in a different era of financial management guided by dual computational intelligence.	Manjaly <i>et al.</i> , 2021 ^[20]
3	Adoption of artificial intelligence in banking services	AI proves vital for fraud detection in banking, but challenges like regulatory gaps, data privacy concerns, and skill shortages impede adoption. Quantitatively, positive attitudes, perceived usefulness, and trust strongly drive AI adoption intention, with attitude mediating the link between perceived usefulness and adoption in banking services.	Rahman <i>et al.</i> , 2023 ^[23]
4	Artificial intelligence impact on banks employees and clients in an Asian developing country	AI enhances banking transactions but may jeopardize certain technical jobs; however, it falls short in replacing humans in roles demanding emotional intelligence for client and employee relationship management in banks.	Boustani 2022 ^[5]
5	Artificial Intelligence in Finance	Despite the financial sector's leadership in AI adoption, challenges in data, cybersecurity, and ethics pose risks to regulatory objectives. Traditional external governance is insufficient due to increased information asymmetry, data dependency, and interdependency, making AI supervision in finance exceptionally challenging.	Zetzsche <i>et al.</i> , 2020 ^[27]
6	Applications of Artificial Intelligence in commercial banks	AI transforms commercial banking across lending, risk management, fraud detection, compliance, and marketing, enhancing accuracy, profitability, and customer service. It optimizes operations, reduces costs, and enables new services, making it integral across core business areas.	Königstorfer <i>et al.</i> , 2020
7	Artificial Intelligence in the Banking Industry	AI is sought by banks to emulate fintech efficiency without extensive change, utilizing dynamic capabilities for reconfiguring traditional banking. Future research could explore additional experiences, including those of banks like Santander and BBVA, which acquire AI capabilities through firm acquisitions.	Gómez <i>et al.</i> , 2024
8	Artificial Intelligence in the Indian Banking and Financial Industry	AI-powered Fintech revolutionizes credit assessment by utilizing alternative data, increasing credit access for previously underserved individuals. The future lies in, streamlining processes, offering quick and cost-effective solutions, and driving investments in innovative technologies like bots for efficient and error-free operations.	Deepthi and Bansal, 2024 ^[7]
9	Artificial Intelligence (AI) in Banking & Consumer's Perspective	It reveals positive links between predictors and AI adoption intentions in the shift from traditional to AI-based banking, noting a negative association with perceived risk. It calls for practical recommendations, highlighting evolving consumer intentions and advocating for more precise research methods.	Noreen 2023 ^[22]

The primary goal of this paper is to provide a detailed analysis about the integration and impact of AI in the banking and finance industry in the 21st century. It seeks to

1. Examine the diverse applications and benefits of AI adoption in the banking and finance sector, including fraud detection, risk assessment, automated customer service, and investment advisory services.
2. Identify and address the challenges with the adoption of AI, including information security, data protection and ethical considerations.
3. Highlight the promising prospects of AI in this industry, emphasising further innovation, enhanced customer experiences, and a safer, more efficient financial environment.

Need for the study: Recent changes have occurred in the Indian banking sector, driven by shifts in customer behaviour and their temporal conduct. It is crucial to understand how the banking industry is responding to these emerging challenges and which banks are outperforming others during this period of transition.

- **Understanding AI's Impact:** There is a pressing need to comprehensively understand the transformative impact of AI innovations. This study shows how AI is reshaping traditional practices, driving efficiency, and fostering innovation within the industry.

- **Identifying Opportunities and Challenges:** As AI continues to revolutionize the banking and finance sector, it is crucial to identify the opportunities and challenges it presents for various stakeholders, including financial institutions, regulators, and consumers. This research aims to uncover both the possible advantages, including enhanced decision-making and enhanced customer experiences, as well as the associated risks, including data security concerns and job displacement.
- **Exploring Societal and Economic Implications:** The extensive integration of AI in the banking and finance has far-reaching societal and economic implications, ranging from changes in employment patterns to shifts in market dynamics. This study seeks to explore these implications in depth, shedding light on issues such as income inequality, digital inclusion, and the need for new regulatory frameworks to address emerging challenges.
- **Informing Strategic Decision-Making:** By providing idea about the present landscape and future direction of AI in the banking and finance industry this research aims to inform strategic decision-making among industry stakeholders. Whether it be policymakers seeking to craft effective regulatory policies and operation optimization of financial institutions, this

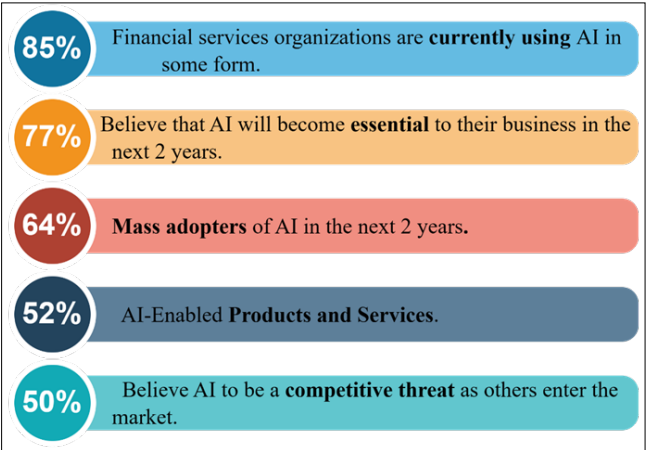
study aims to offer actionable recommendations based on sound empirical analysis and expert opinions.

- **Contributing to Academic Discourse:** Lastly, this study contributes to the academic discourse surrounding the convergence of banking, and finance and AI. By synthesizing existing research, analyzing case studies, and offering new insights. The research aims to advance scholarly understanding of the opportunities and challenges associated with adoption of AI in the financial services sector.

Research Methodology: The study adopts a secondary data analysis approach to the integration and impact of AI in the Banking and Finance industry. Secondary data, including e-journals, manuals, academic articles, industry reports, case studies, and online resources, were the primary sources of information for this study. The methodology is structured as data collection and data analysis. Data collection from peer reviewed articles, from academic databases such as JSTOR, Google Scholar, and ScienceDirect was examined to extract theoretical frameworks, empirical studies, and previous research on AI applications in the sector. To capture recent information on the practical applications, challenges, and innovations surrounding AI, reputable online resources, blogs, and platforms like Medium, LinkedIn, and industry-specific news outlets were referenced.

AI in Banking and Finance:

AI has become very important in the banking and finance sector due to its ability to transform and optimise various aspects of the industry. According to a recent survey conducted by the Cambridge Centre for Alternative Finance and the World Economic Forum, a significant number of business leaders plan to extensively integrate AI within their operations within the next few years. They foresee AI is playing a pivotal role in driving their business forward.



Data Source: The World Economic Forum's: <https://www.weforum.org>

Fig 1: AI Adoption Trends and Strategic Outlook among Financial Services Organization

Here are some key points regarding the importance of AI in this sector, along with references to support these claims:

1. **Management of risk:** AI can enhance risk assessment and management by processing large data sets to

- identify potential threats and anomalies in real-time, which helps in preventing fraudulent activities.
2. **Customer Service:** Chatbots and virtual assistants governed by AI provide efficient, 24/7 customer support, handling routine inquiries and transactions. For instance, Gartner said that since 2022, emerging technologies like chatbots and virtual assistants have been involved in 54% of customer interactions.
3. **Fraud Detection:** AI is useful in detecting fraudulent transactions and activities in real-time by analysing patterns and deviations from the norm, helping banks and financial institutions protect their customers. A Teradata case study found that machine learning reduced false positives by 60%, with potential improvement to 80% as the model evolved. ML enhances data processing efficiency while minimising AI false positives.
4. **Credit Scoring:** AI can improve the accuracy of scoring models by analysing a wide data sources, enabling more informed lending decisions. A study published in the CEUR Workshop Proceedings (CEUR-WS.org) found that machine learning algorithms can improve credit scoring accuracy by as both ANN and CNN models demonstrated high accuracy, with ANN reaching 95.4% and CNN achieving 94.3%. 15% compared to traditional methods.
5. **Algorithmic Trading:** AI algorithms can decide trades in real-time based on market and historical data, optimising trading strategies. The World Economic Forum suggests that AI-driven algorithmic trading systems can execute trades in milliseconds, improving market liquidity and efficiency. (Source: World Economic Forum)
6. **Personalised Financial Services:** AI can analyse customer data to offer personalised investment and financial advice, helping individuals make better financial decisions. A Capgemini press report indicates that 73% of customers would be willing to use personalised financial services provided by AI. (Capgemini: <https://www.capgemini.com>)
7. **Cost Reduction:** AI can automate various processes, improve efficiency and reduce operational costs in areas like compliance, data entry, and document processing. A report by Autonomous Research suggests that AI technologies could cut operational costs for financial services firms by up to 22%, potentially saving \$1 trillion by 2030. (ginimachine <https://ginimachine.com> › Blog ginimachine Report)
8. **Compliance and Regulatory Reporting:** AI helps financial institutions to ensure compliance with complex and evolving regulations by analysis automation of vast amounts of data and generating accurate reports. A report by IBM indicates that AI can reduce the cost of compliance by up to 56% and improve the accuracy of regulatory reporting. For most Food Industries, AI is about achieving better visualisation, analysis and methods to generate ideas, automation and efficiency (IBM Institute for Business Value).

State Bank of India (SBI)	HDFC Bank	ICICI Bank	Punjab National Bank (PNB)	Bank of Baroda	Axis Bank	Union Bank of India	National Payments Corporation of India (NPCI)	Directorate General of Foreign Trade (DGFT)
								
SIA	EVA	iPal	Pihu	ADI	Axis AHA	UVA	PAi	VAHEI
SBI Intelligent Assistant	Electronic Virtual Assistant	AI-powered Virtual Banking Assistant	AI-powered Virtual Assistant	AI-powered Virtual Assistant	AI-powered Virtual Assistant	Union Virtual Assistant	NPCI's AI-powered Assistant	Virtual Assistant for Help on Export-Import

Fig 2: AI-Based Virtual Assistants Deployed by Major Indian Banks and Financial Institutions

AI is crucial in the banking and finance sector as it enhances risk management, customer service, fraud detection, credit scoring, trading strategies, and more. Its ability to analyse vast data sets and provide real-time insights has the potential to drive efficiency, reduce costs, and improve the overall customer experience, making it a valuable tool for financial institutions.

Some Case Studies

AI chatbots are increasingly utilised in the Indian finance sector to enhance customer service and streamline operations. These chatbots can provide instant support for common queries, assist in account management, and offer personalised financial advice. They boost efficiency, shorten response times, and enhance customer experience. Indian banks and financial institutions are adopting AI to remain competitive in the fast-changing financial sector. Regulatory compliance and data security are crucial considerations in their implementation.

Table 2: Examples of successful AI integration in the Indian Finance Sector

S.No.	Institute name	AI program name
1	SBI	SIA (SBI Intelligent Assistant)
2	HDFC	Eva (Electronic virtual assistance)
3	ICICI	I pal
4	PNB	Pihu (Pnb's Instant Help for You)
5	Bank of Baroda (BOB)	ADI (Assisted Digital Interaction)
6	AXIS BANK	Axis aha
7	UBI	Uva (Union bank's virtual assistant)
8	NPCI	Pai (National payment corporation of India)
9	The Directorate General of Foreign Trade (DGFT)	VAHEI (Virtual Assistant to Help Exporters and Importers)

Emerging Trends and Technologies in AI

Machine Learning: Machine learning algorithms are widely used for algorithmic trading, credit risk assessment, fraud detection. As AI models get more organised, they can better analyse large datasets and make more accurate predictions (Kalyani and Gupta, 2023) ^[16].

Natural Language Processing (NLP): NLP is used for chatbots, virtual assistants, and sentiment analysis. This technology is improving customer service, automating routine inquiries, and even assessing market sentiment through the analysis of news and social media (Herrmann and Masawi, 2024).

Robotic Process Automation (RPA): It streamlines repetitive tasks that are rule-based like data entry and document processing through automation. It reduces operational costs and improves efficiency in back-office operations.

Blockchain and AI Integration: Combining blockchain with AI can increase the transparency and security of financial transactions. This is important in areas like cross-border payments and supply chain finance.

Explainable AI: As AI systems become more complicated, the need for explainable AI is growing. This will be crucial in regulatory compliance and risk management.

AI's Potential Impact on the Future of Banking and Finance:

AI is expected to play a vital role in the development of autonomous vehicles, healthcare solutions, and digitally advanced cities (Varshney, 2023) ^[26]. Quantum computing, is also expected to revolutionize AI by significantly increasing processing power (Fatunmbi, 2025) ^[10].

Improved Customer Experience: AI-driven chatbots and virtual assistants provide real-time customer support, personalised recommendations, and faster query resolution, enhancing customer satisfaction.

Risk Management: AI processes large datasets to evaluate credit risk, identify fraud, and forecast market trends with greater accuracy, minimising financial losses.

Cost Reduction: Automation of routine tasks through AI and RPA can significantly reduce the cost savings for financial institutions.

Enhanced Compliance: AI can help with ensuring and monitoring compliance with ever-evolving regulations, reducing the risk of non-compliance and associated fines.

Algorithmic Trading: AI-powered trading algorithms can make fast decisions based on market data, potentially increasing profits and reducing human errors.

Personalised Financial Services: Through customer data analysis AI provide tailored financial products and personalised investment advice.

Ethical Considerations and AI Regulations in the Financial Industry:

The growth of AI has also raised concerns about ethics, and the impact of automation on jobs and society (Bostrom, and Yudkowsky, 2018) ^[4]. These concerns have led to discussions and regulations surrounding AI ethics.

Data Privacy and Security: As financial institutions process huge customer-sensitive data. To ensure privacy and security of customer data is of paramount importance. Compliance with regulations and local data protection laws is essential for this (Alzaidi, 2022) ^[2].

Algorithm Bias: AI use in lending, underwriting, and in financial processes has raised concerns about algorithmic bias. Regulations may require transparency and fairness in AI decision-making (Dwivedi *et al.*, 2021) ^[8].

Transparency and Explainability: Regulations might mandate that AI models be transparent and explainable, especially when making decisions that impact customers' financial lives (Hentzen *et al.*, 2022) ^[13].

Regulatory Compliance: Financial regulators are increasingly recognising the impact of AI and are developing guidelines and regulations specific to its use in the industry. Compliance with these regulations is crucial (Herrmann and Masawi, 2022) ^[14].

Consumer Protection: Regulations may focus on ensuring that AI is used to benefit consumers and that financial institutions don't exploit AI for unethical practices (Dwivedi *et al.*, 2021) ^[8].

AI have a huge impact on the banking and finance sector, offering opportunities for improved efficiency, better customer experiences, and more accurate decision-making. However, the industry must also grapple with ethical considerations and evolving regulations to ensure responsible and fair use of AI. Staying up to date with these trends and complying with relevant regulations will be crucial for financial institutions in the AI-powered future.

Conclusion

In this paper, we have delved into the evolutionary impact of Artificial Intelligence (AI) on the banking and finance industry in the digital era. From its historical roots in the 1950s to its current transformative role, AI has witnessed periods of growth, retreat, and resurgence, ultimately becoming an indispensable part of the modern banking and financial landscape.

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